

1.5 COMMISSIONING

- .1 Systems commissioning will be conducted prior to substantial completion. The purpose of the Commissioning is to ensure all systems are functioning as designed prior to substantial completion.
- .2 Commissioning will require the presence of knowledgeable representatives of the necessary Mechanical Trades. The Mechanical Contractor shall include all necessary costs for systems commissioning. The Contract Administrator will participate to the extent deemed necessary.
- .3 All aspects of mechanical systems operations will be operated, checked and verified. If any portion of the work fails to meet design requirements, the Commissioning procedure will be halted and only resumed when all necessary repairs are completed. All extra costs including costs for the Contract Administrator to revisit the site resulting from this postponement will be borne by this Contractor.
- .4 **The Contractor shall submit, to the Contract Administrator, a commissioning report detailing the commissioning tests performed and the results of these tests. Format of report is to be one sheet for each piece of mechanical equipment and it shall include: Equipment tag, Description, Location and point form description of tests and results.**

1.6 COMPLETION

- .1 After completing tests and adjustments remove temporary covers, and strainers, and obstructions to flow. Drain, flush and refill piping systems as often as required until all piping is clear of dirt and debris.
- .2 Leave Mechanical work in specified working order.
- .3 Provide spare components as specified in other Sections of Divisions 21, 22 & 23.
- .4 Provide one set of all specialized tools required to service equipment as recommended by manufacturers.

1.7 CONTRACT DRAWINGS AND SPECIFICATIONS

- .1 Drawings and specifications are complementary each to the other, what is called for by one shall be binding as if called for by both. Many items, such as valves, vents, thermometers, pressure gauges, etc. are shown only on schematics and are not shown on plan and elevation views. Provide and install all items shown in any or all of the drawings (or schematics).
- .2 Should any discrepancy appear between the drawings and specifications, which leave the Contractor in doubt as to the true intent and meaning of the plans, and specifications, the Contractor shall obtain a ruling from the Contract Administrator in writing **before submitting a tender**. If this is not done it will be assumed that the most expensive alternative has been included in the tender price. For any ruling to become binding, the Contract Administrator must issue the new direction in a published addendum.
- .3 Examine all contract documents, including all drawings, specifications and work of other trades to ensure that work is co-ordinated and satisfactorily carried out without changes to the building or contract value.

- .4 The drawings for mechanical work are performance drawings. They are generally diagrammatic and are not to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and should not be used as an excuse for deficiencies or omissions.
- .5 Follow the recommended installation details and procedures for equipment as found in Supplier technical data, supplemented by contract document details.
- .6 Install piping, ductwork, etc., generally in the locations and routes shown on the drawings, close to the building structure to minimize furring and interference with other services or free space. Remove piping, ductwork, etc. that is not properly installed and replace to the satisfaction of the City/Contract Administrator at no additional cost.
- .7 Be completely responsible for the acceptable condition and operation of systems and equipment components forming part of the installation or associated with it. Promptly replace defective materials, parts and equipment and repair related damage.
- .8 The drawings are intended to convey the scope of work and indicate general arrangement and approximate location of apparatus and fixtures, and indicate the general location and route to be followed by pipes and ducts. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use of space through which they pass, while allowing adequate space for service, maintenance, repair, or replacement for all equipment.
- .9 All serviceable items, such as valves, controls, bearings, filters and similar items, must be installed in such a manner as to be accessible for service, maintenance, repair and replacement without the removal of other material or equipment, and without the need for specialized equipment such as lifts, harnesses, or other safety items. Basically, work to be installed to allow easy equipment isolation and servicing functions while all surrounding systems continue to operate.
- .10 All individual pieces of equipment shall be provided with appropriate means of isolation and bypass so that systems may continue to operate during maintenance of individual components. It is understood that this may not be possible in all situations, but this is a requirement where isolation is possible.
- .11 Drawings and specifications to be considered as an integral part of contract documents and neither drawings nor specifications are to be used alone. Misinterpretation of requirements of plans or specifications shall not relieve Contractor of responsibility of properly completing work to approval of Contract Administrator.
- .12 Obtain information involving accurate dimensions from dimensions shown by site measurement. Visit and inspect the site of the work to verify location and elevation of existing services which may affect the Tender and work of this Division (water, electrical, sanitary, ductwork etc.) before submission of tender and proceeding with work. Make all necessary changes or additions to runs to accommodate structural conditions (pipes or ducts around beams, columns etc.) without additional expense to the City. Locations of pipes, ducts and other equipment to be altered without charge to City, provided change is made before installation and does not necessitate additional materials and that all such changes are acceptable to the Contract Administrator and are suitably recorded on Record Set of Drawings.

- .13 Confirm on the site the exact location and mounting elevation of outlets and fixtures as related to existing Mechanical & Electrical components.
- .14 As work progresses and before installing piping, ductwork, fixtures and equipment interfering with interior treatment and use of building, consult Contract Administrator for appropriate action before proceeding. This applies to all levels and proper grading of piping. If Contractor fails to perform above checking and fails to inform Contract Administrator of such interference, Contractor to bear all subsequent expense to make good the installation.
- .15 Refer to Structural drawings for roof construction details. These shall relate to roof supports, piping penetrating roofs, etc. as indicated on mechanical detail sheets.
- .16 Alter, at no additional cost, the locations of materials and/or equipment as directed that do not necessitate additional material.

1.8 CUTTING AND PATCHING

- .1 Cutting, core drilling, patching and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment and piping, and/or installation of new equipment and piping to be included by Divisions 21, 22 & 23 - Mechanical in tender price. Divisions 21, 22 & 23 to employ and pay appropriate sub-trade whose work is involved, for carrying out work described above.
- .2 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening, the opening size will be the minimum required, and that patching will be the responsibility of the trade making the opening to the original or specified conditions.
- .3 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.

1.9 PAINTING

- .1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .2 Prime and paint marred finished paintwork to match original.
- .3 Restore to new condition finishes which have been damaged too extensively to be merely primed and touched up.

1.10 DOCUMENTATION AND SYSTEMS ACCEPTANCE

- .1 Provide the following on substantial performance of the work:
 - .1 As-Built drawings: As-built information is to be recorded as detailed elsewhere in this Section. Submit As-Built drawings to Contract Administrator for review prior to total completion.
 - .2 Assemble the specified quantity of O&M manuals in D-ring binders with index tabs, each containing this Sub-Contractor's and suppliers names and telephone numbers, data sheets, valve charts, brochures, operating, maintenance, and lubricating instructions as well as number coded wiring diagrams and a complete set of

reviewed shop drawings for all equipment provided by this Division. Present all copies to the Contract Administrator for review.

- .3 Extended warranty certificates, where specified in other Sections of Divisions 21, 22 & 23.
- .4 Air and water balancing report. The work of Divisions 21, 22 & 23 will not be considered totally performed until acceptance by the Contract Administrator of the Air and Water Balancing Report.

1.11 EQUIPMENT PROTECTION AND CLEANUP

- .1 Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Clean exposed surfaces of mechanical equipment, ductwork, piping, etc., and polish plated work.
- .3 Remove tools, surplus and waste material from the building site upon completion. Clean grease, dirt and excess material from walls, floors, ceilings and fixtures for which this Contractor was responsible, and leave the premises suitable for immediate use.

1.12 EXAMINATION OF THE SITE AND DOCUMENTATION

- .1 Prior to submitting tender, carefully examine site conditions, adjacent buildings and local conditions at the site, which could affect the work of this Division.
- .2 Examine all contract drawings to ensure work can be performed without changes to the building, or work, as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences has been brought to Contract Administrator's attention, in writing, prior to closing of tenders.
- .3 Verify that materials and equipment can be delivered to the place of the work and that sufficient space and access is available to permit installation thereof in locations shown on the drawings.

1.13 GUARANTEES AND WARRANTIES

- .1 Guarantee satisfactory operation of all work and apparatus installed under this contract. Replace, at no expense to the City, all items, which fail or prove defective within a period of time as define in Division 1, but in no circumstances shall the warranty period be less than one (1) year after final acceptance of complete contract by the City. Make good all damage incurred as a result of failure or repair of mechanical work.
- .2 No certification given, payment made, partial or entire use of equipment by the City, shall be construed as acceptance of defective work or acceptance of improper materials. Make good at once, without cost to the City, all such defective work or materials and consequence resulting, within the period of time defined in Division 1, but not less than one (1) year from time of final acceptance date.
- .3 This general guarantee shall not act as a waiver for any specified guarantee and/or warranty of greater length of time noted elsewhere in these documents.

- .4 Comply with requirements of Division 1. Where warranties specified in Division 1 are longer, or more stringent than in Divisions 21, 22 & 23, Division 1 shall govern. Provide warranties on specified products, equipment and components as well as on the installation of these items. Include for all costs for cutting and patching, removals and restoration materials and work and repairs to other equipment affected in performance of warranty work.
- .5 Provide warranty certificates, wherever given or required, that are in excess of the normal warranty period showing the name of the firm giving the warranty, dated and acknowledged, on specific equipment and system.

1.14 INSTRUCTIONS TO THE CITY

- .1 At the completion of the work, the Contractor shall instruct and demonstrate to the City's employee(s), or City's representative, who will have charge of the equipment, the operation, maintenance care, and adjustment of all parts of the system to satisfaction of Contract Administrator.
- .2 Demonstrate the specific starting, stopping, controlling and general maintenance requirements for each major piece of equipment and system.
- .3 Demonstrate all mechanical systems and provide a Contractor guided tour of the facility to point out all locations of equipment, dampers, control devices and the like.

1.15 LIABILITIES

- .1 Install concealed pipes and ducts neatly, close to building structure so furring is minimum size. Pipes, ducts and equipment installed improperly, to be removed and replaced without cost to City.
- .2 Co-ordinate work with other sections to avoid conflict and to ensure proper installation of all equipment. Review all contract drawings.

1.16 MECHANICAL SUBTRADES

- .1 Submit, with the tender, the names of all Sub-Trades to be used on this project as well as the extent of work to be performed by each.
- .2 Contractor to have minimum five years experience in field of mechanical contracting and to have successfully performed work of similar nature and approximate size to that indicated in specifications and on drawings.

1.17 OPERATING AND MAINTENANCE MANUALS

- .1 Provide O & M Manuals to the Contract Administrator for review 2 weeks prior to final inspection. Incorporate Contract Administrator's review comments into final copies.
- .2 Provide three (3) sets of manuals in separate 3 "D" ring, loose leaf binders with spine and face pockets, with the project name clearly indicated on the spine and face. The final accepted copies shall be provided to the City.
- .3 General catalogue data for the Operations and Maintenance Manual is unacceptable. If manufacturer's specification sheets are generalized in any way, they shall be clearly marked to show exactly which item has been supplied, and the project designation for that item (e.g.,

PRV-1) is to be noted on Manufacturer's specification sheet which includes all details for this unit, including complete model number, serial number, and construction & performance data.

- .4 The outline for the Operating & Maintenance Manual shall be as follows:
 - Contractor and Subcontractor Contact Information
 - Purpose
 - General Description
 - Operating Instructions
 - Seasonal Operations
 - Normal Valve Positions and Control
 - Recommended Inspection and Preventative Maintenance
 - Maintenance Schedule
 - Description of Maintenance Procedures
 - Recommended Major Equipment Spare Parts List
 - Appendices
 - Equipment Shop Drawings
 - Equipment Supplier Schedule
 - Manufacturer Recommended O & M Information
 - Exploded Views and Parts Lists
 - As-Built Drawings (reduced)
 - Control Narrative
 - Control Drawings
- .5 Include the following information in the manuals, incorporated into the outline format above, as applicable:
 - .1 Mechanical Systems
 - .1 Maintenance Tasks - including daily, weekly, monthly, semi-annual and annual checks.
 - .2 Lubrication Information.
 - .3 List of Contractors and Equipment Suppliers including contact information
 - .4 Parts and Troubleshooting Information.
 - .2 Certification and Identification
 - .1 Inspection Certificates
 - .2 Balance Reports
 - .3 Component Information
 - .1 Section for each type of equipment to include shop drawings, installation and maintenance information.
 - .4 Safety Information
 - .5 Also provide the following information:
 - .1 Include control diagrams, (including Building Automation System diagrams), sequence of operations, and service instructions (calibration, trouble shooting, etc.).

- .2 Provide Manufacturer's preventive maintenance procedures (recommended lubrication materials and procedures, frequency, etc.).
- .3 System and equipment troubleshooting guides.
- .4 A copy of the final balancing reports.

1.18 PERFORMANCE OF WORK

- .1 Protect and maintain work until work has been completed and accepted. Protect work against damage during installation. Cover with tarpaulins if necessary. Repair all damage to floor and wall surfaces resulting from carrying out of work, without expense to the City.

1.19 PERMITS, FEES AND INSPECTIONS

- .1 Apply for, obtain, and pay for all permits, licences, inspections, examinations and fees required for work of Divisions 21, 22 & 23.
- .2 Review drawings with authorities having jurisdiction to ensure compliance with all applicable codes and by-laws.
- .3 In case of conflict, codes and regulations take precedence over the contract documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein. Any discrepancies must be brought to the Contract Administrator's attention in writing.
- .4 Before starting any work submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Contract Administrator immediately of such changes. Prepare and submit any additional drawings, details or information as may be required.

1.20 RECORD DRAWINGS

- .1 Obtain one set of drawings and specifications and, as the job progresses, mark these prints clearly in red pencil to accurately indicate installed work, as well as alterations to ductwork, piping, equipment and associated work changes and deviations from work shown on Contract Drawings, including all Addenda and Work Order Changes.
- .2 As-Built drawings to be maintained on a continuous basis to ensure they are up-to-date and accurate, and have current prints available for inspection at the site at all times.
- .3 Submit this set of record drawings to the Contract Administrator for review on completion of the work. Should the record drawings be lacking information or details of changes made, they will be returned to the contractor. The contractor is to, without additional cost to the City or Contract Administrator, make the required site inspections, etc. and update the record drawings to the satisfaction of the Contract Administrator.

1.21 REGULATORY REQUIREMENTS

- .1 Comply with the most stringent requirements of all Municipal, Provincial and Federal Bylaws and Ordinances, the requirements of Utilities such as Manitoba Hydro, and all sections of this specification.

- .2 Provide necessary notices, obtain permits and pay all fees, in order that work specified may be carried out.
- .3 Furnish certificates confirming work installed conforms to requirements of authorities having jurisdiction.

1.22 SHOP DRAWINGS

- .1 Submit to the Contract Administrator for review a maximum of four (4) sets of detailed shop drawings.
- .2 Check shop drawings for conformity to plans and specifications prior to submission.
- .3 Submit shop drawings for all items specified in the sections of Divisions 21, 22 & 23. For equipment, provide performance, physical and operating data as described in the Specifications and listed in equipment schedules. Provide performance curves for all pumps and fans.
- .4 Shop drawings shall include copies of applicable brochure or catalogue material clearly indicating manufacturer and model. Ambiguous shop drawings will not be reviewed.
- .5 Clearly mark submittal to indicate all differences from the specified material. The Contract Administrator will require all options and material indicated on the shop drawing to be provided and installed. Specifically note on the submittal specified features such as tank linings, pump seal materials, painting finish, etc.
- .6 Include dimensional and technical data sufficient to determine if equipment meets requirements, including weights, loading points, electrical data and motor sizes.
- .7 Identify the equipment by system name and number, e.g. " S1, Second Floor, Air Supply Fan", "P1, Chilled Water Pump", etc.
- .8 Installed materials and equipment shall meet specified requirements regardless of whether or not the shop drawings were reviewed by the Contract Administrator.
- .9 Each drawing to include name of project, equipment supplier and clause number equipment is specified under.
- .10 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "By Others" or "By Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of contract, unless specifically noted to contrary.
- .11 Take full responsibility for securing and verifying field dimensions. In cases where fabrication must proceed prior to field dimensions being available, check all shop drawings and approve for dimensions only. In this case guarantee that dimensions will be worked to and ensure that other sub-trades are aware of these dimensions and shall comply with them.
- .12 Review by Contract Administrator shall be mutually understood to refer to general design only. If errors in detailed dimensions or interference with work are noticed, attention of Contractor will be called to such errors of interferences, but Contract Administrator's review of drawings will not in any way relieve Contractor from responsibility for said errors or

interferences, or from necessity of furnishing such work, and materials as may be required for completion of work as called for in contract documents.

- .13 This review by the Contract Administrator is for the sole purpose of ascertaining conformance with the design concept.
- .14 Do not order equipment until the Contract Administrator has reviewed and returned the reviewed shop drawings.
- .15 Keep one set of shop drawings on the site.
- .16 Bind one complete set of checked shop drawings in each operating and maintenance instruction manual.

1.23 SITE REVIEW

- .1 The Contractor's work will be reviewed periodically by the City, Contract Administrator or their representatives, solely for the purpose of determining general quality of work. Guidance will be offered to Contractor in interpretation of plans and specifications as assistance to carry out work.
- .2 Reviews and directives given to Contractor, his agents, servants and employees does not relieve the Contractor, his agents, servants or employees of their responsibility to provide the work in all its parts in a safe and workmanlike manner, and in accordance with plans and specifications, nor impose on City, and/or Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any work.

1.24 SPECIAL TOOLS AND SPARE PARTS

- .1 Furnish the City with spare parts as follows:
 - .1 Spare parts as detailed in individual Sections of Divisions 21, 22 & 23.

1.25 STANDARDS

- .1 Conform to the best modern practices of workmanship and installation methods and employ only skilled tradesmen working under the direction of fully qualified personnel.

1.26 STANDARD OF MATERIAL

- .1 All materials and equipment installed under this contract shall be new unless otherwise noted.
- .2 Materials and equipment specified and acceptable manufacturers are named in this specification for the purpose of establishing the standard of materials and workmanship to which Contractor shall adhere. Tender price shall be based on the use of materials and equipment as specified.
- .3 Provide new material and equipment of first class quality, delivered, erected, connected and finished in every detail, and supplied with the acceptance of the Contract Administrator. Assume responsibility of ensuring that provided equipment performs as specified.

- .4 In the preparation of the tender, if a Sub-Contractor neglects to name the manufacturer where accepted equals have been shown, it will be understood that the specified equipment will be provided.
- .5 Requests for approval of equals must be submitted not less than seven days prior to closing date of the tender, and submissions must bear proof of acceptance by the City or Contract Administrator if used in the tender.
- .6 Assume full responsibility for ensuring that, when providing accepted equals, all space, weight, connections, power and wiring requirements, etc. are considered and adjusted costs are included in the tender. Alternative equipment requiring greater than specified energy requirements or unduly limiting service space requirements will not be accepted.
- .7 All additional costs for mechanical, electrical, structural and architectural revisions required to incorporate materials accepted as an equal and substituted by Contractor shall be responsibility of Contractor.
- .8 Equipment listed as "equal" in specifications or submitted as equal by the Contractor must meet all space requirements, specified capacities and must have equipment characteristics of specified equipment as interpreted by Contract Administrator. Install equipment in strict accordance with Manufacturer's published recommendations.

1.27 SUBSTANTIAL COMPLETION

- .1 Prior to requesting any substantial completion inspection, complete all of the following items.
 - .1 All systems shall be operational with alarms, interlocks and control functions.
 - .2 Obtain all certificates of approval from the authorities having jurisdiction.
 - .3 All manufacturer start-ups shall be complete.
 - .4 Complete valve tagging and identification of all new mechanical systems and components.
 - .5 Lubricate all equipment as per manufacturers' instructions.
 - .6 Submit O & M Manuals and perform operator training.
 - .7 Provide all Manufacturers' reports required by specifications.
 - .8 Complete System Commissioning
 - .9 Complete all previously identified deficiencies.
 - .10 Clean equipment both inside and out.
 - .11 Complete final air and water balancing and submit reports.
 - .12 Complete final calibration.
 - .13 Provide As-Built record drawings in accordance with the tender documents.

1.28 SUPERINTENDENCE

- .1 Maintain qualified job site personnel consisting of licensed tradesmen and registered apprentices with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

1.29 TEMPORARY USE OF EQUIPMENT

- .1 Permanent systems and/or equipment not to be used during construction period, without the City's permission.
- .2 Temporary use of equipment shall in no way relieve Contractor of providing warranties, as described elsewhere in this Section and in Division 1, on all equipment and systems so used.
- .3 Operate systems under conditions that ensure no temporary or permanent damage. Operate systems with proper treatment. Operate fans at proper resistance with filters installed. Change filters at regular intervals and prior to final acceptance. Operate with proper safety devices and controls installed and fully operational.
- .4 Under no circumstances shall air handling units, heat recovery ventilators or other air systems be used to provide temporary heating, cooling or ventilation during construction. Air systems (air handling units and heat recovery ventilators) shall only be operated after all drywall sanding and carpet installation (or any other operation that creates considerable dust or fibres) is complete.

1.30 WELDING REGULATIONS

- .1 Welding shall be performed by welder holding current welder's certificate from Provincial Department of Labour.
- .2 Suitable fire extinguishers are to be present during welding operations and during fire watch period.
- .3 During welding or soldering ensure structure is protected against fire, shield with fire-rated sheets and galvanized iron sheets.
- .4 Maintain a fire watch for a minimum of 1 hour after welding operations are complete.

1.31 WORKMANSHIP

- .1 Only first class workmanship will be accepted, not only as regards to safety, efficiency, and durability but also as regards to neatness of detail. Pipework must be installed parallel to, or at right angles to building planes. The entire work shall present a neat and clean appearance on completion.

Part 2 Products

- .1 NOT USED.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 00 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 DEMONSTRATION

- .1 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Contractor shall record these demonstrations on video tape for future reference.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories. The following piping systems are to be insulated and jacketed.
 - .1 Hydronic Piping.
 - .2 Domestic water piping (DHW & DCW).
 - .3 Drainage piping (SS) where exposed under ADA compliant lavatories and toilets to protect against contact.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .2 ASTM C547, Mineral Fiber Pipe Insulation.
 - .3 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .2 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to ASTM C547.
 - .2 Jacket: All Service Jacket.
 - .3 Maximum "k" factor: to ASTM C547.
 - .4 Applications: condensate drain piping, new hydronic piping and new domestic water piping.
 - .5 Acceptable Material: "Schuller", "Micro-lok", or "Knauf"

FLUID TEMPERATUR E (°C)	NOMINAL PIPE SIZES		
	1 in. and Under	1 ¼ in. to 2 in.	2 ½ in. to 4 in.
5 – 29	1 in.	1 in.	1 in.
30 – 49	1 in.	1 in.	1 in.
50- 90	2 in.	2 in.	1 in.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, 2 in. wide minimum.
- .2 Contact adhesive: quick setting.

2.4 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.
- .2 Quick-setting for joints and lap sealing of vapour barriers.

2.5 JACKETS

- .1 ASJ (in mechanical rooms):
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: compatible with insulation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: at valves, strainers and flanges. Do not insulate unions at equipment.
- .2 Design: to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: ASJ.

3.5 INSTALLATION OF FORMED CLOSED-CELL INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

- .2 TIAC Code: A-3.
 - .1 Securements: Tape at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .3 TIAC Code: A-6.
 - .1 Insulation securements: per manufacturer's recommendations.
- .4 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed run-outs to plumbing fixtures, chrome plated piping, valves or fittings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for pre-engineered wet chemical fire protection systems.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 21 05 01 - Common Work Results - Mechanical.
- .4 Section 23 05 05 - Installation of Pipework.
- .5 Section 28 31 01 - Fire Alarm Systems.

1.3 REFERENCES

- .1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
 - .1 ANSI/NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
 - .2 ANSI/NFPA 17A, Standard for Wet Chemical Extinguishing Systems.
- .2 Underwriters' Laboratories Inc. (UL)
 - .1 UL 21, Standard for LP-Gas Hose.
 - .2 UL 252, Standard for Compressed Gas Regulators.
 - .3 UL 300, Standard for Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas.
 - .4 UL 1254, Standard for Pre-Engineered Dry Chemical Extinguishing System Units.
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 ULC/ORD-C 1254.6, Fire Testing of Restaurant Cooking Area Fire Extinguishing Systems Units

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide ULC listed maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 COMPONENTS

- .1 ULC listed pre-engineered automatic fire suppression system using a wet chemical agent for grease related fires in areas associated with ventilating equipment including hoods, ducts, plenums and filters. The fire suppression system shall consist of the following equipment:
 - .1 Wet chemical agent: The extinguishing agent shall be specially formulated, aqueous solution of organic salts with a pH range between 7.7 – 8.7, designed for flame knockdown and foam securement of grease related fires.
 - .2 Agent tank: (see Section 2.2)
 - .3 Regulated release mechanism: The regulated release mechanism shall be spring-loaded mechanical type capable of providing expellant to one 3 gallon agent tank. A factory installed regulator deadest at 110 psi with external relief of 180 psi shall be installed. Actuation capabilities shall be automatic through a fusible link detection system and manual actuation by a mechanical pull station.
 - .4 Discharge nozzles: Each discharge nozzle shall be tested and listed with the R-102 system for a specific application. Nozzle tips shall be stamped with flow number designation. Each nozzle shall have a metal or rubber blow-off cap to keep nozzle tip orifice free of cooking grease build-up.
 - .5 Distribution piping: Distribution piping shall be Schedule 40 chrome plated or stainless steel conforming to ASTM A53 and A106.
 - .6 Detectors: The detectors shall be the fusible link style designed to separate at a specific temperature.
 - .7 Cartridges: The cartridge shall be a sealed steel pressure vessel containing either carbon dioxide or nitrogen gas. The cartridge seal shall be designed to be punctured by the releasing device supplying the required pressure to expel wet chemical agent from the storage tank.
 - .8 Agent distribution hose: An agent distribution hose shall be available for kitchen appliances manufactured with casters. This shall allow the appliance to be moved for cleaning purposes without disconnecting the appliance fire suppression protection. Hose assembly shall include a restraining cable kit to limit appliance movement within range of the flexible hose.
 - .9 Flexible conduit: An option for flexible conduit in lieu of rigid EMT conduit shall be provided for installation of pull stations and mechanical gas valves. Flexible conduit shall be UL listed and include all approved components for proper installation.
 - .10 Pull station assembly: The pull station shall be designed as a manual actuation system with built-in guard to protect the pull handle. The pull handle shall be designed for three finger operation and be red in colour for quick visibility.
 - .11 Fire suppression releasing enclosure: Enclosure shall be a stainless steel enclosure to house the release assembly, regulator, expellant hose and agent storage tank. The

cover shall contain an opening for a visual status indicator. The enclosure shall include ½" knockouts for conduit and micro switch for connection to fire alarm panel shall be included.

Acceptable Product: ANSUL R-102 Restaurant Fire Suppression System

Acceptable Vendor: Simplex-Grinnell or approved equal.

- .2 Design to ANSI/NFPA 17A, to protect against commercial cooking grease fires.
- .3 Design systems to UL 1254 requirements; include in operating manual the following:
 - .1 Description of system operating details.
 - .2 Description of fire risks to be protected.
 - .3 Pipe and fitting limitations.
 - .4 Nozzle limitations, including maximum dimensional and area coverage, and installation location.
 - .5 Requirements for equipment maintenance.

2.2 AGENT TANK

- .1 Tank shall be constructed of stainless steel and be installed in a stainless steel enclosure or wall bracket. The tank shall contain the main bank of extinguishing agent and expellant gas. 3.0 gallon capacity, working pressure of 110 psi, test pressure of 330 psi and minimum burst pressure of 600 psi.
- .2 Pressure gauge shall be supplied with tank.
- .3 Caps, plugs or valves connected to pressurized cylinder must have at least four full threads of engagement.
- .4 Provide means of relieving pressure when minimum of two full threads are engaged between device and cylinder, to prevent potential injury when cylinder valve assembly is pressurized while being serviced.

2.3 PIPING AND FITTINGS

- .1 To ANSI/NFPA 17A.
- .2 Finish: chrome finish or polished stainless steel in exposed areas.
- .3 Scarf or notch bottom of siphon tubes used to transport extinguishing agent through pressure vessel and valve to distribution piping to provide for uninterrupted flow of extinguishing agent.
- .4 Pressure regulators to comply with applicable requirements of UL 252.
- .5 Hose assemblies used for distributing extinguishing agent to comply with applicable requirements in UL 21.

2.4 NOZZLES

- .1 Stainless steel or non-ferrous with satin finish.
- .2 Provide frangible discs or blow-off caps as indicated or specified.

2.5 FIRE DETECTION SYSTEM

- .1 ULC listed, automatic, to ANSI/NFPA 17A.

2.6 OPERATING DEVICES

- .1 ULC listed operating system to ANSI/NFPA 17A.
- .2 Provide one manual control ULC listed operating station to ANSI/NFPA 17A, located as per requirements from the authority having jurisdiction.
- .3 Shut down devices in accordance with manufacturer's listing.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with ULC listing and manufacturer's listed instruction manual.

3.2 SITE TESTS

- .1 Test to acceptance in accordance with ANSI/NFPA 17A.
- .2 Testing to be witnessed by fire commissioner and authority having jurisdiction.
- .3 Test system units for use with each type of cooking appliance referenced in manufacturer's installation instructions. Conduct tests in accordance with appropriate fire test method specified in UL 300.

3.3 RECHARGING

- .1 After completion of tests, ensure agent tank contains correct chemical and weight of extinguishing agent and expellant gas. Restore systems to normal condition.

END OF SECTION